User Training Manual

Kinect 3D Scanner

SpaceShop

Ames Research Center
Moffett Field, CA

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SPACESHOP
Kinect 3D Scanner Training Manual

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REVISIONS		
VERSION	**DESCRIPTION**	**DATE**
A	Original Version	12-19-13

I. Introduction

This document is for the user qualification training of the Kinect 3D Scanner located at the Ames SpaceShop facility on the 2nd floor in Building 220. Before a user operates the machine, he/she must have signed the required documentation as described in the "SpaceShop Standard Operating Procedures" documentation. For additional information, please see the SpaceShop Manager.

II. Kinect 3D Scanner

The Kinect 3D Scanner is a machine that allows users to scan anything and convert it into a digital format, whether it be a CAD file for making modifications or an STL file for 3D printing. The machine consists of a Base (where the Kinect rests when not in use), a Kinect Grip Kinect itself; The Kinect's components may be analyzed in Figure 1 and Figure 2.

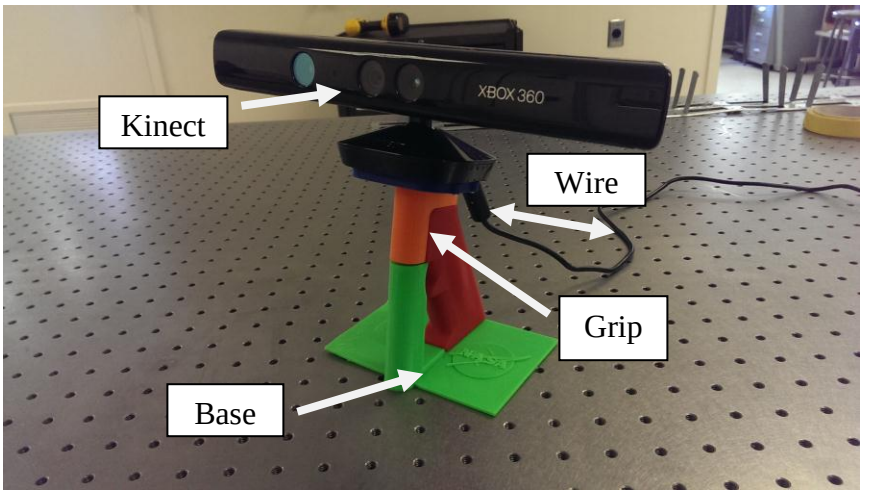


Figure 1: Kinect Resting on Stand

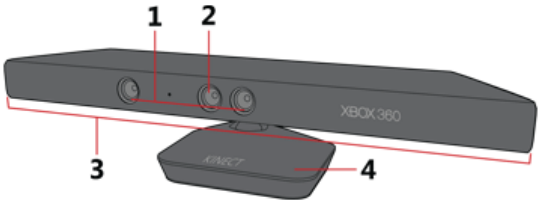


Figure 2: Kinect Components

1. 3-D Depth Sensors: Three-dimensional sensors track the object in space.
2. RGB Camera: An RGB (red, green, blue) camera helps identification, and takes both pictures and videos.
3. Multiple Microphones: An array of microphones along the bottom, front edge of the Kinect sensor can be used for recording audio.
4. Motorized Tilt: A mechanical drive implemented in the base of the Kinect sensor may automatically tilt up and down when needed (Not used for our purposes).

III. Safety Precautions

a. Kinect 3D Scanner Safety

- You **SHALL NOT** use the machine with a damaged AC adapter, USB-Connector, loose electrical outlet, or with otherwised exposed electronic circuitry.

- You **SHALL NOT** stare directly into the Kinect's laser sensor. Retinal damage may occur if you stare directly into the sensor.
- You **SHALL NOT** modify the USB or electrical power cord, nor subject it to excessive bends, twists, pulls, binding, or pinching, nor placing any object of weight on it.
- You **SHALL NOT** remove the Kinect 3D Scanner from the Lab unless you are given permission by a SpaceShop staff member to do so.
- You **SHALL** make sure the Kinect is fully functional before using it.
- You **SHALL** always point the scanning device in an appropriate manner, consistent with NASA Safety Protocols.

IV. Step-by-Step Tutorial

Below is a step-by-step tutorial for the Kinect 3D Scanner.

1. Before using the scanner, make sure the USB cable is **SECURELY PLUGGED** into the computer, and the AC power adapter is plugged into an electrical wall outlet nearby. If connected correctly, a green LED on the scanner should blink.

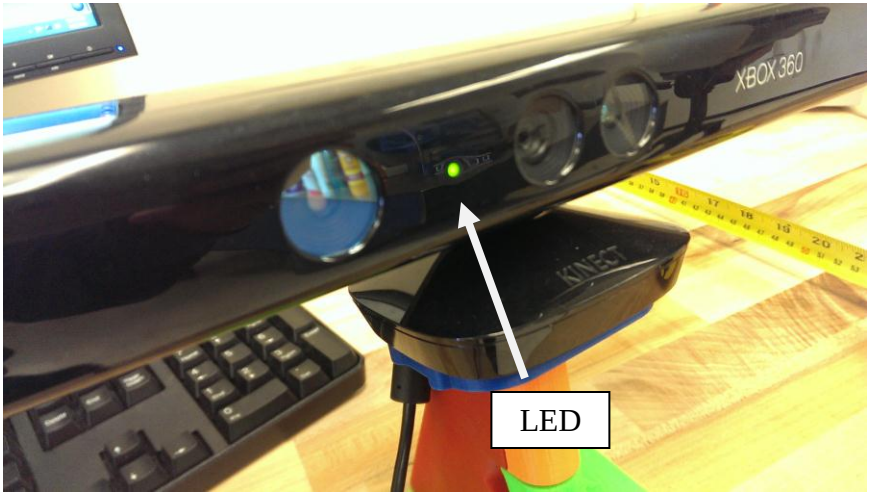


Figure 3: Kinect LED

2. Open the Skanect software located on the desktop or start bar of the computer.

Prepare

3. Once the software is loaded, you should have a screen will resemble the image below (Fig. 4).

Figure 4: Skanect Launch Screen

4. **IDENTIFY** the object you wish to scan, click on the **NEW** tab and select the appropriate scene and bounding box (FIG. 6) based on the object type and physical size.
    a. The final scanned file will be saved into a **TEST FOLDER**. You may create a folder within the current **TEST PATH** for your own project.
    b. Recorded models may be loaded through **LOAD** tab (FIG. 5).

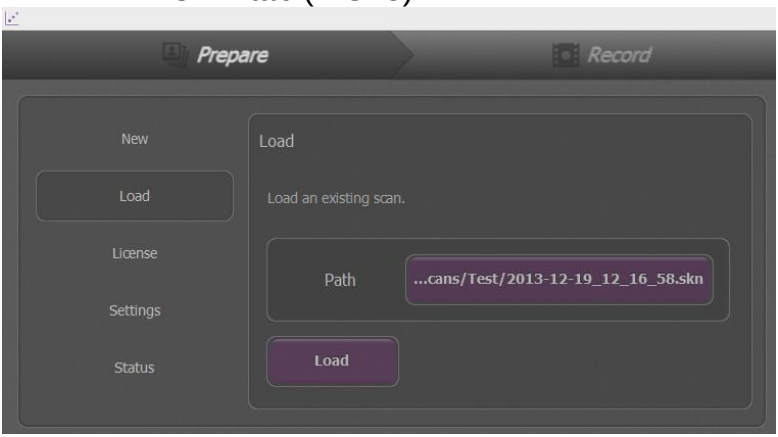


Figure 5: Loading previous model

5. Once bounding preferences have been checked, click **START** to proceed to the **RECORD** tab.

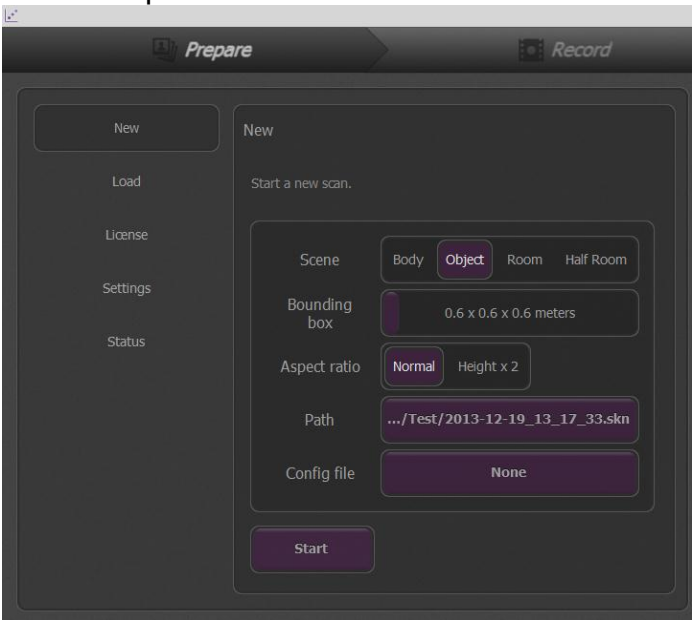


Figure 6: Bounding Preferences

Record

6. The top left box allows for altering the delay counter before image capture begins
    a. Changing the limit time will alter the duration the images are captured for.
7. Alter the distance of the object with respect to the Kinect until the object is displayed on the screen within the bounding box.
    a. If no object is visible, and no images of the Kinect's feed are displayed on the top right of the software display, then please restart the computer. ***Restarting the computer will alleviate Kinect-Skanect connection issues.***

8. Once the object is in focus and the correct time parameters are set, clicking on the **RED CLOCK** will start the timer and start capturing the object.
9. If the object is to remain stationary during scanning, refer to step 10; If object is to be rotated, skip to step 13.

STATIONARY OBJECT(S) / ROTATING SCANNER

If the object is to remain stationary during the scanning, then the Kinect scanner must be rotated around the object to provide for a 3D Model.

10. Start rotating the scanner (from an optimized starting point) around the object.
    a. Skanect provides feedback for the user's ability to capture the images successfully by displaying green or red frames
        i. Green frames signify successful capturing
        ii. Red frames show what is not being captured
        iii. If **NOT ENOUGH GEOMETRY** text appears (FIG. 7), then rotate the object slower, or move the camera further from the object being scanned.
    b. Better scans are frequently those which were done slower. Aim for rotating the scanner around the object at a rate of ~ one revolution a minute (6 degrees/second).

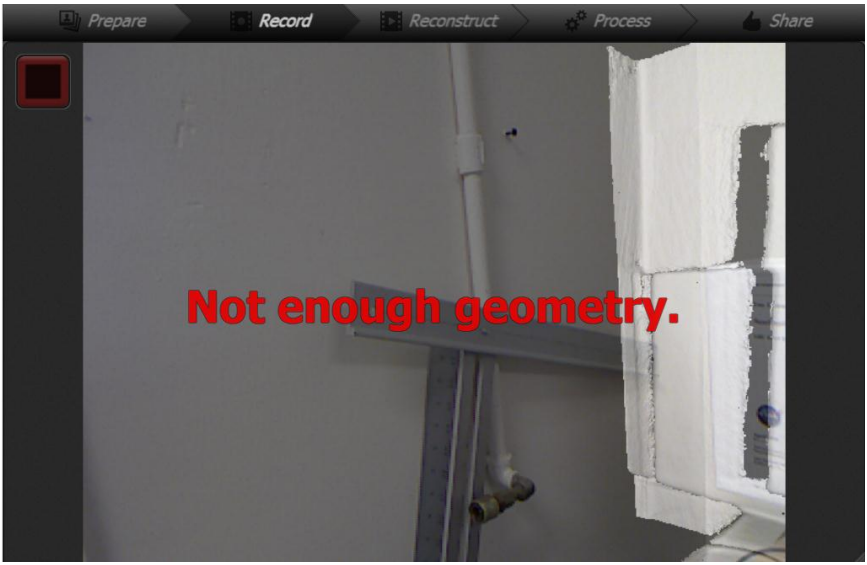


Figure 7: Not Enough Geometry

11. Continue to rotate the scanner until the timer ends. If timer limit has been set to **NONE**, then pressing the red square in the top left will end the exposure.
12. Skip to step 15

ROTATING OBJECT(S) / STATIONARY SCANNER

If the object is to be rotated during the scanning, then the Kinect scanner must remain stationary while the object rotates to provide a satisfactory 3D Model.

13. Start Rotating the object very slowly in front of the Kinect.
    a. Skanect provides feedback for the user's ability to rotate the object successfully by displaying green or red frames (FIG. 8).
        i. Green frames signify successful capturing
        ii. Red frames show what is not being captured.

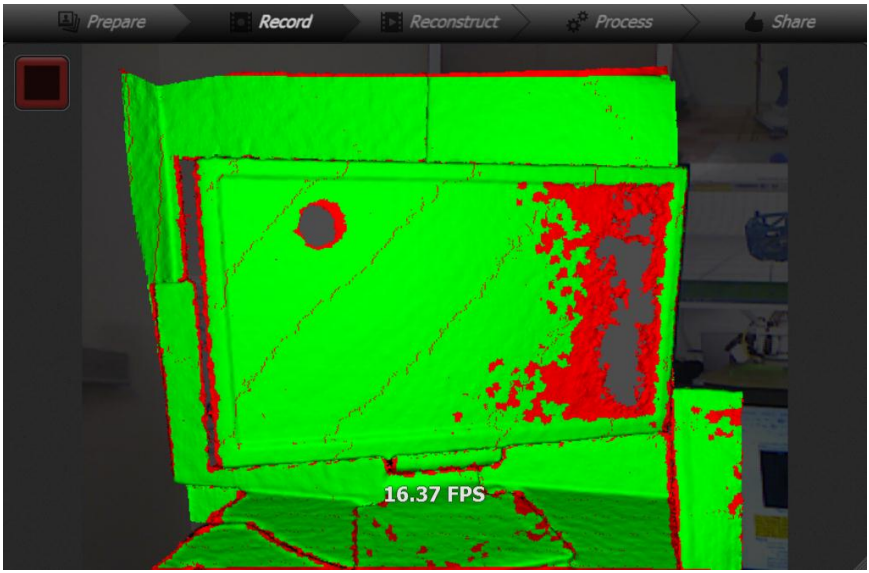


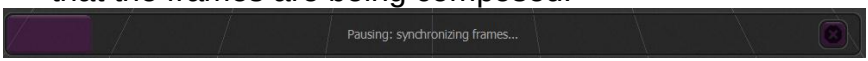
Figure 8: Capture Feedback

iii. If **NOT ENOUGH GEOMETRY** text appears, then rotate the object slower, or move the camera further from the object being scanned.

b. Better scans are frequently those which were done slower. Aim for rotating the object ~ one revolution a minute (6 degrees/second).

14. Continue to rotate the object until the timer ends. If timer limit has been set to **NONE**, then pressing the red square in the top left will end the exposure.

15. A purple bar will load at the bottom notifying the user that the frames are being composed.



16. Once the model has been rendered, it may be viewed as so:
    a. Rotating around the modelt: *Holding left-click* and moving the mouse
    b. Panning around the plane of the model: *Holding scroll (middle) click* and moving the mouse
    c. Zooming in or out of the model: *Holding right-click* and moving mouse up or down.
17. If the model renders poorly, it may be deleted by clicking the red **TRASH** button on the left.

Pressing the circular clock will start the timer once again for another rendering.

18. If model rendering is satisfactory (FIG. 9), you may proceed to the **PROCESS** tab to alter the model (FIG. 10).

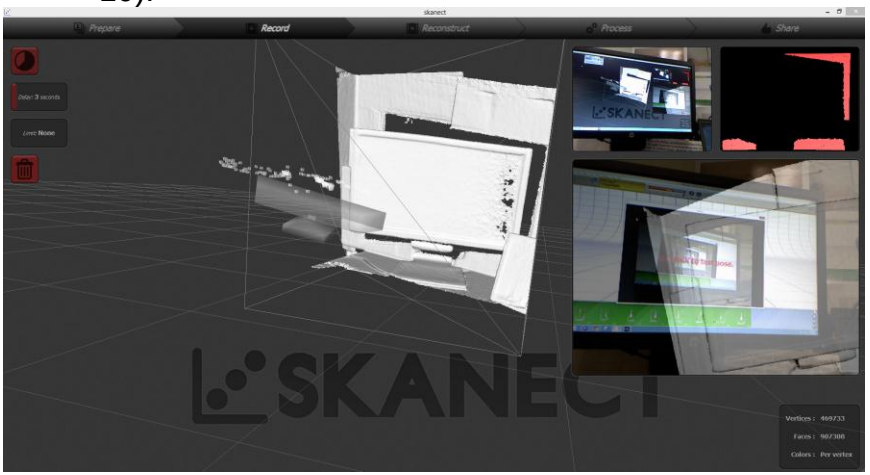


Figure 9: Quick Model Capture

Process

19. If rendering has surfaces that need filling, you may select **FILL** (FIG. 11) under the **GEOMETRY** bar
    a. Alternatively, you may select **WATERTIGHT** (FIG. 10) under the **MESH** bar for an automated coloring & filling of the model.

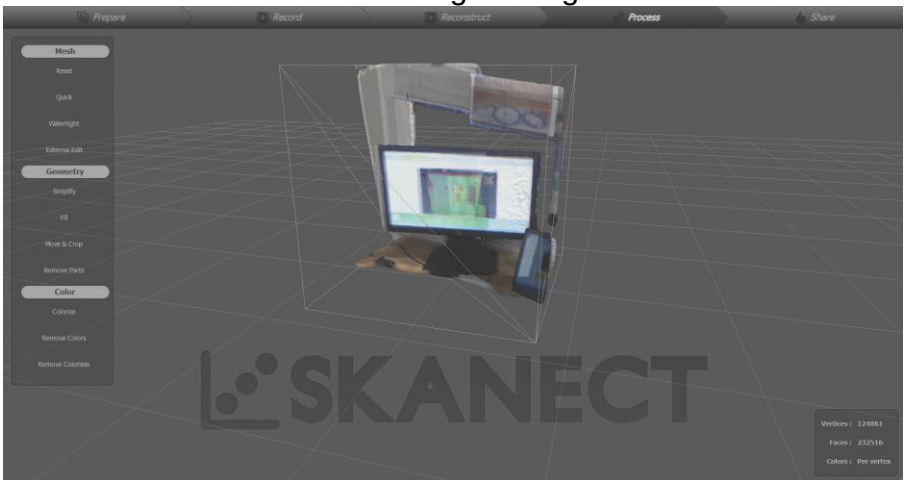


Figure 10: Watertight Example

20. If there are extraneous small objects on the screen, clicking **REMOVE PARTS** under the Geometry tab will allow for the user to select a physically-scaled range of objects to be removed from the model.
21. **MOVE & CROP** will crop, rotate, and translate the model about the filling box as per the user's input.

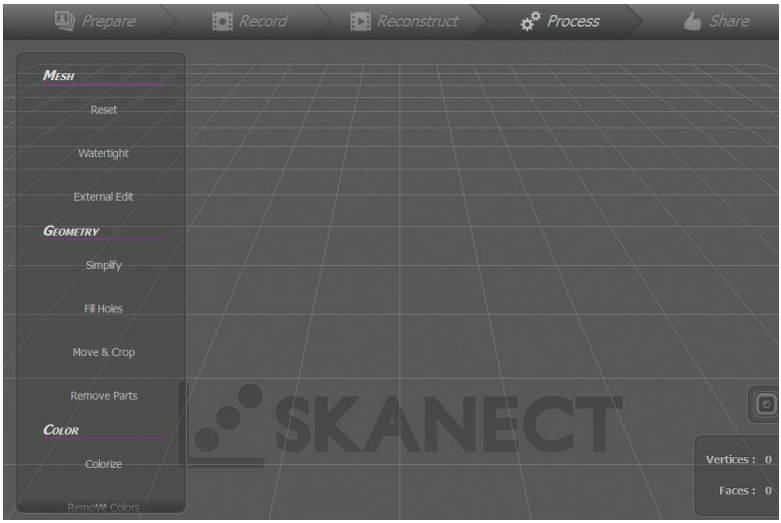


Figure 11: Processing Page

22. For extremely complex models, **SIMPLIFY** will reduce the number of faces displayed on the object for a simpler model.
23. Coloring of the model may be underwent either by clicking **WATERTIGHT** from the **MESH** bar, or **COLORIZE** from the **COLOR** bar.
    c. Removing added color from the object may be done so by clicking **REMOVE COLORS** under the **COLOR** bar.
    d. **REMOVE COLORLESS** allows for all of the uncolored portions of the model to be removed. This is mainly applicable after **COLORIZE** or **WATERTIGHT** have been used.
24. A model may be reset to the original construction by clicking **RESET** under the **MESH** bar
    e. **RESET** is a good way to undo an edit that yielded undesirable results.

Share

25. The model may now be saved under the **SHARE** tab (FIG. 12), and **LOCAL** bar. **SAVE** will allow for the captured images to be stored
    f. Stored images may be reconstructed as models by reloading them into Skanect.

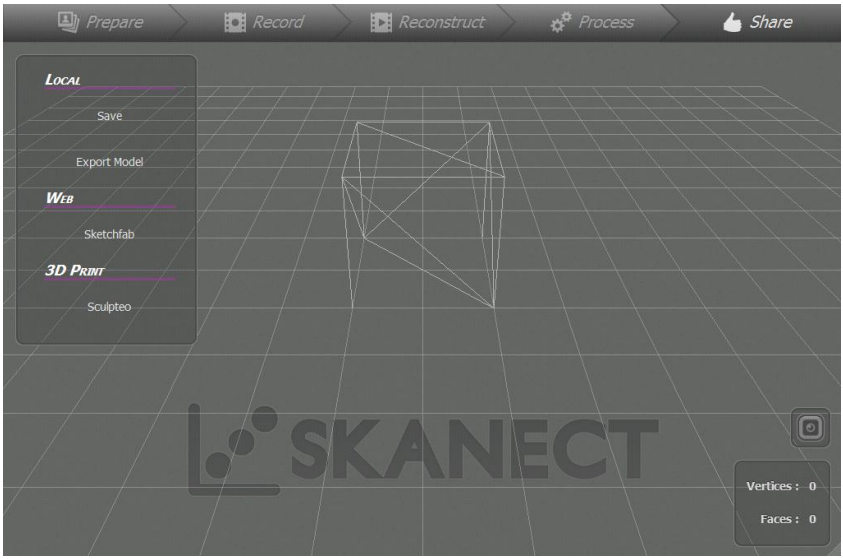


Figure 12: Share Page

26. **EXPORT** allows for a low resolution model to be exported as different file formats for use with other software.
    g. **.STL** files are directly compatible with the SpaceShop UP! 3D printer.

27. Congratulations on finishing the Kinect 3D Scanner Tutorial!

To learn more advanced techniques, such as how to edit the scan in different ways, please consult the SpaceShop Lead for more information.